Chem-Dyne Site
Second Five-Year Review Report

Hamilton, Ohio

September 2005

Prepared By:

Ohio Environmental Protection Agency, Southwest District Office

for

U.S. Environmental Protection Agency, Region V

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United States Environmental Protection Agency

Date:

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List of Acronyms and Abbreviations

ARARs	Applicable or Relevant and Appropriate Requirements
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CCL	Consturction Completion List
EA	Endangerment Assessment
FS	Feasibility Study
MCL	Maximum Contaminant Level
NCP	The National Contingency Plan
NPDES	National Pollution Discharge Elimination System
OAC	Ohio Administrative Code
PRPs	Potentially responsible parties
RAP	Remedial Action Plan
RAOs	Remedial action objectives
RI	Remedial Investigation
RCRA	Resource Conservation and Recovery Act
Site	The Chem-Dyne Site
Trust	The Chem-Dyne Trust
VOC	Volatile Organic Compound

Executive Summary

The Remedial Action Plan (RAP) for the Chem-Dyne Site, dated May 1985, required a remedy consisting of four components. These components were: demolition of all Site buildings, removal of "hot spot" soil, installation of a cap over remaining soils, and the installation of a ground water extraction-injection system. The results of this five year review indicate that remedy is functioning within the compliance criteria established by the Consent Decree. The remedy remained protective of human health and the environment. It also continued to meet compliance with applicable or relevant and appropriate requirements.

The Trust proposed that the ground water extraction system be considered fully operational in January 1988. It has been operating continuously since then. It maintained hydraulic containment for the period covered by the five year review. Although ground water extraction has been successful in removing significant dissolved phase mass from the aquifer, future operation of the system will prove primarily effective for hydraulic containment. The mass removal efficiency of the ground water extraction system has become steady over the past several years; yet a significant ground water plume remains. Results indicate that the persistent nature of the ground water plume is attributable to residual source material. This residual source material, comprised predominantly of volatile organic compounds, is more difficult to remedy than dissolved phase mass. It is not naturally attenuating at an efficient rate. Therefore, in order to meet the termination criteria of the Consent Decree in a more efficient time frame, Ohio EPA recommends that the Trust explore means of identifying source areas and then aggressively treating those source areas with in-situ remedial technologies.

Implementation of the changes to the ground water extraction system prescribed in the Work Plan for Changes to the Groundwater Extraction System at the Chem-Dyne Site, Hamilton, Ohio (revised Dec. 21, 2004) began on October 5, 2004. The change consisted of shutting down 13 of 23 extraction wells. Since then, quarterly monitoring results indicate hydraulic containment is being maintained with fewer operational wells. At the same time, implementation of the plan is providing results that will enable validation of the ground water flow and transport model. These results will assist in providing a clearer understanding of the nature of the plume.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Chem-Dyne		
EPA ID *(from WasteLAN)*: OHD074727793		
Region: 5	**State:** Ohio	**City/County:** Hamilton / Butler

SITE STATUS	
NPL status: ☒ Final ☐ Deleted ☐ Other (specify)_____	
Remediation status (choose all that apply): ☐ Under Construction ☒ Operating ☐ Complete	
Multiple OUs?* ☐ YES ☒ NO	**Construction completion date:** 09/11/1992
Has site been put into reuse? ☐ YES ☒ NO	

REVIEW STATUS	
Lead agency: ☒ EPA ☒ State ☐ Tribe ☐ Other Federal Agency _____	
Author name: Matt Justice	
Author title: Site Coordinator	**Author affiliation:** Ohio EPA, Southwest District
Review period: 08/09/2000 to Signature Date of this five-year review	
Date(s) of site inspection: 06/01/2005	

Type of review:

☐ Post-SARA ☒ Pre-SARA ☐ NPL-Removal only
☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead
☐ Regional Discretion

Review number: ☐ 1 (first) ☒ 2 (second) ☐ 3 (third) ☐ Other (specify) _____

Triggering action:

☐ Actual RA Onsite Construction at OU # ☐ Actual RA Start at OU#____
☐ Construction Completion ☒ Previous Five-Year Review Report
☐ Other (specify)

Triggering action date *(from WasteLAN)*: September 8, 2000

Due date *(five years after triggering action date)*: September 8, 2005

* ["OU" refers to operable unit.]
** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form

Issues:
A review of data covering the past five years indicates the remedy is functioning as intended. No compliance issues were identified.

Recommendations and Follow-up Actions:
Although ground water extraction has been successful in removing significant dissolved phase mass from the aquifer, future operation of the system will prove primarily effective for hydraulic containment. The mass removal efficiency of the ground water extraction system has become steady over the past several years; yet a significant ground water plume remains. Results indicate that the persistent nature of the ground water plume is attributable to residual source material. This residual source material, comprised predominantly of volatile organic compounds, is more difficult to remedy than dissolved phase mass. It is not naturally attenuating at an efficient rate. Therefore, in order to meet the termination criteria of the Consent Decree in a more efficient time frame, Ohio EPA recommends that the Trust explore means of identifying source areas and then aggressively treating those source areas with in-situ remedial technologies.

Protectiveness Statement(s):
The site remedy is protective of human health and the environment. The ground water extraction system prevents migration of a ground water VOC plume.

I. Introduction

The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. The objective of this five-year review report is to summarize the protectiveness of the remedy, identify issues of concern, and to provide recommendations for addressing those issues. Ohio EPA prepared this five-year review pursuant to Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) §121 which states:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

Ohio EPA also prepared this five-year review pursuant to The National Contingency Plan (NCP); 40 CFR §300.430(f)(4)(ii) which states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

Policy five year reviews are triggered by the date a site qualifies for listing on the Consturction Completion List (CCL). Chem-Dyne qualified for the CCL on the date of signature for the final Close Out Report. The interim close out report was completed September 11, 1992. The first policy five year review was submitted by Ohio EPA on August 9, 2000 and signed on September 8, 2000 by U.S. EPA. This second review spans the period August 2000 through August 2005.

II. Site Chronology

Table 1.

Date	Event
Late 1950's	Ford Motor Company ceased operation of factory at the Site location
1974-1979	Site was used for the processing and storage of chemical wastes
September 8, 1983	Site finalized for NPL
May 22, 1984	Remedial Investigation completed
November 19, 1984	Feasibility Study completed
July 5, 1985	Remedial alternative selection in the enforcement decision document signed
October 9, 1985	Consent Decree lodged between U.S. EPA, Ohio EPA, and PRPs
January 1, 1988	Operational ground water extraction system approved
1992	Ground water re-injection operations terminated
November 1998	Ohio EPA issued permit discontinuing air monitoring requirement
September 8, 2000	First five-year review approved
October 4, 2004	13 ground water extraction wells shut down as part of two year flow model validation

III. Background

Physical Characteristics

The Chem-Dyne Site is located at 500 Joe Nuxhall Boulevard, Hamilton, Ohio. The 21 acre site is bound by the Ford Hydraulic Canal to the north, residential areas and athletic fields to the south, athletic fields to the east, and industrial areas to the west. The Site is located approximately 1,000 feet east of the Great Miami River (Figure 1).

Land and Resource Use

Topography in the Site vicinity is relatively flat. Average depth to water is approximately 25 feet below ground surface. Ground water flow beneath the Site is westerly toward the Great Miami River. The Remedial Investigation, completed in 1984, concluded that ground water flow velocities ranged form 0.5 to 1.5 feet per day. Ground water flow is heavily influenced by the stage of the Great Miami River, and localized pumping. The geology of the Hamilton, Ohio area is dominated by glacial valley fill deposits that overlie bedrock of Ordovician age limestones and shales. In the Hamilton area, glacial deposits are thickest where they fill the bedrock valleys of the ancient Teays River System. The modern-day Great Miami River follows these valleys for much of its course, including the vicinity of Hamilton (Papadopulos and Associates, 2003). Deposits filling the valleys are approximately 150 to 200 feet thick (Watkins and Spieker, 1971). Most of these deposits are coarse grained sands and gravels saturated with water. The saturated deposits constitute a prolific aquifer known as the Miami Valley Sole Source Aquifer System. The sole source aquifer designation is a federal designation used to protect drinking water supplies in areas with few or no alternative sources of drinking water. The sole source aquifer designation protects an area's ground water resources by requiring U.S. Environmental Protection Agency review of any proposed projects within the designated area that are receiving federal financial assistance.

The most significant active pumping centers near the Site are the Hamilton North well field, pumping at an average rate of 2 million gallons per day (mgd), and the Hamilton Power Plant wells. The Hamilton Power Plant wells have produced approximately 0.8 mgd since year 2000 (Papadopulos and Associates, 2003).

History of Contamination

Ford Motor Company operated a factory at the Site which ceased operations in the late 1950s. Later, between 1974 and1979, the Chem-Dyne Corporation used the Site for the processing and storage of chemical wastes. During this time, the Site accepted an estimated 112,000 drums of waste from approximately 200 generators. Materials handled included pesticides, chlorinated and un-chlorinated solvents, waste oils, plastics and resins, PCBs, acids and caustics, metal and cyanide sludges, and laboratory wastes. Over 30,000 drums and 300,000 gallons of bulk materials were on-Site when operations ended in 1980.

Initial Response
Most of the materials left on Site in 1980 were removed under the supervision of a state court appointed receiver between 1980 and 1981. Subsequent waste removal actions began in 1982. The remaining wastes were removed during a surface clean-up under U.S. EPA removal authority in 1983. The Site was proposed for inclusion on the National Priorities List on October 21, 1981, and finalized on September 8, 1983.

Basis for Taking Action
The Remedial Investigation (RI), completed May 22, 1984, identified extensive VOC unsaturated soil contamination. The highest VOC concentrations were located 3 to 6 feet below ground surface (bgs). Elevated concentrations extended as deep as 25 feet bgs. Structures and utilities on-site were found to be contaminated with a variety of materials. The Feasibility Study (FS), released on November 19, 1984 contained an Endangerment Assessment (EA). The assessment concluded that direct contact with soil contaminants presented an unacceptable risk.

The RI defined a ground water plume. The plume, comprised predominantly of chlorinated ethenes and chlorinated ethanes was found to emanate from the Site. In 1986, this plume was confirmed to be approximately 1,000 feet wide, 1,800 feet long, and up to 50 feet deep. The EA concluded that ground water contamination presented an unacceptable risk for potable use. It also concluded that continued migration of the ground water plume could present an unacceptable risk to downgradient water supplies.

IV. Remedial Actions

Remedy Selection
Following negotiations with the potentially responsible parties (PRPs), a Remedial Action Plan (RAP) was developed for the Site. The RAP, dated May 1985, served as the basis for Remedial Alternative Selection in the Enforcement Decision Document, signed on July 5, 1985. The selected remedy for the Site required the demolition of all Site buildings, the removal of "hot spot" soil, the installation of a cap over remaining contaminated soils, and the installation of a ground water extraction-injection system. On October 9, 1985 a Consent Decree between U.S. EPA, Ohio EPA, and 173 PRPs was lodged in U.S. District Court, for the Southeastern District of Ohio, Western Division. Under the Consent Decree, the PRPs agreed to form the Chem-Dyne Site Trust Fund (Trust), for the purpose of overseeing implementation of the requirements of the decree.

Remedy Implementation
Soil hot spots were removed and disposed at an approved off-site facility in an expedited action in the spring of 1985. A total of 8 buildings were demolished. A perimeter utility cutoff trench approximately 4,000 feet in length and 15 feet deep was excavated around

the Site and all intercepted utilities were sealed. A storm sewer system for draining the capped Site was installed.

Monitoring wells were installed to further define the boundaries of the migrating ground water plume. Ground water remediation activities began in February 1987 with completion of a ground water extraction-injection system. A total of 25 extraction wells and 8 injection wells were installed. After several modifications, the Trust proposed that the ground water extraction system be considered fully operational on January 1, 1988. Thus January 1, 2005 marks the 17th year of operations since the proposal. Re-injection operations were terminated in 1992.

The ex-situ ground water treatment system consists of an air stripper. Approximately 10,000 feet of piping were installed to connect water pumped from extraction wells to the air stripper. Off-gas from the air stripper was directed to three activated carbon beds for treatment. Treated water was either injected into the aquifer in order to flush VOCs from subsurface soils, or discharged to the Ford Hydraulic Canal in accordance an NPDES permit issued by Ohio EPA.

System Operations

Five year review guidance establishes policy for U.S. EPA to review and analyze remedial action operations as it is pertains to promulgated federal and state law. The Enforcement Decision Document contains a discussion of environmental laws associated with the construction and long-term maintenance and monitoring of the systems associated with the Site. Environmental laws that were determined to apply to the Site include the Resource Conservation and Recovery Act (RCRA), the Clean Water Act, the Clean Air Act, The Safe Drinking Water Act, and the Toxic Substances Control Act (TSCA). Section IV, paragraph C1 of the Consent Decree states that "all activities undertaken...pursuant to this Consent Decree shall be undertaken in accordance with the requirements of all applicable local, state and federal laws, regulations and permits."

Resource Conservation and Recovery Act

The Site has a RCRA permit to operate as a generator of RCRA regulated materials. This includes off-Site shipments of waste materials generated from air stripper cleaning. Provisions of RCRA applicable to the Site also include the technical standards for the placement of the final cap.

In 1999, Ohio EPA, Division of Hazardous Waste Management (DHWM) and the Trust agreed that acid washing of the tower packing material, and carbon regeneration could cease. On June 7, 2005, DHWM conducted a compliance evaluation inspection of the Site. The purpose of the inspection was to determine the compliance status of the Site with applicable Ohio hazardous waste rules and laws. Ohio EPA found that no regulated hazardous waste was present. The Site was found to be in compliance with applicable Ohio hazardous waste rules and laws.

Safe Drinking Water Act

Results obtained in April and September 2004 show that no chlorinated solvents exceeded the MCL in the western compliance wells. However in September 2004, trichloroethene was detected in shallow western compliance well MW-16 above the MCL at a concentration of 6.07 ug/L. No adjacent public water systems contain VOCs above drinking water standards.

Clean Water Act

Ground water from the Site is extracted by pumping wells. The pumped water is treated by an air stripper prior to being discharged to the Ford Hydraulic Canal. This activity is regulated by Section 307(b) of the Clean Water Act. The State of Ohio issues National Pollution Discharge Elimination System (NPDES) permits to the Site for discharging treated ground water to the canal. The last permit was renewed on March 1, 2001. The permit will expire on February 28, 2006.

Since issuing the last NPDES permit, Ohio EPA, Division of Surface Water issued a notice of violation to the Trust for exceeding the permit limits in December 2001. The Trust also reported a violation for 1,1,2-trichloroethane in June 2002. These violations are now attributed to the need for new packing material in the air stripper tower. A review of historic monthly operating reports revealed that 1,1,2-trichloroethane and 1,1,2,2-tetrachloroethane concentrations had been increasing steadily in the discharged water. Between August 6th and August 14th of 2002, the air stripper had to be shutdown for extensive maintenance. As a result the ground water extraction system also had to be shutdown. The long term effects of calcification and iron precipitation had solidified the packing material, thereby blocking air flow through the tower. The tower packing material was replaced in the summer of 2002. In order to identify the need for preventative maintenance, an annual visual inspection of the packing material is recommended. In addition, an evaluation of trends in effluent concentration with time is recommended in future annual reports. No violations of the VOC effluent limitation for discharges into the canal have occurred since the air stripper maintenance.

Clean Air Act

In November 1998, Ohio EPA issued a letter to the Trust indicating that emissions from the air stripper were of the amount and type to be considered minimal. Therefore, Ohio EPA concluded that a permit would no longer be required. Air monitoring has been discontinued.

V. Progress Since the Last Five-Year Review

Since the last five-year review, the ground water extraction system has continued to achieve hydraulic containment of the ground water plume, as stipulated by the terms of the Consent Decree. The protectiveness statement of the last five-year review stated that the

remedy was operating as intended. It also stated however that a more detailed review of the ground water model was needed. Since then significant progress has been made on the development of a new ground water flow and transport model. This new model updates and refines the earlier model developed in 1996. Ohio EPA, U.S. EPA Region V, and the U.S. EPA Center for Subsurface Modeling Support have worked with the Trust to develop a phased approach for model development and review.

On January 27, 2003 Ohio EPA, and U.S. EPA Region V granted approval of the Trust's conceptual flow model. The Trust continued work on the ground water model and submitted the report Groundwater Flow Model (June 27, 2003). Both Ohio EPA and U.S. EPA provided modifications and/or changes to be made during the continued modeling effort. These comments were summarized in a memo provided by the Trust on October 9, 2003. Both agencies approved of the action item list summarized in the memo. In the memo, the Trust agreed to incorporate the modifications and changes in a final report to be prepared at the completion of the flow and transport modeling effort.

On January 20, 2004, the Trust submitted a memo-report on the transport model. The agencies provided comments in April 2004. A subsequent conference call on May 6, 2004 led to the agency proposal of "exploring means of validating the model through an alternate pumping condition." In response, the Trust submitted the Work Plan for Changes to the Groundwater Extraction System at the Chem-Dyne Site, Hamilton, Ohio, dated July 14, 2004. Agency comments were discussed in a conference call of September 29, 2004 and an addendum to the work plan summarizing agreements was submitted by the Trust. The agency approved implementation of the work plan in early October. On October 4, 2004 13 extraction wells were shut down according to the work plan. A revised work plan was submitted on December 21, 2004.

The revised work plan requires more frequent and comprehensive capture zone and water quality assessment. For two years, VOC samples are to be collected quarterly from 12 shallow zone wells and 7 intermediate zone wells. This past March and June the Trust sampled all available wells. After each event, maps are prepared and submitted to the agencies showing the extent of the total VOC plume in both the shallow and intermediate zones. In order to evaluate validation, the work plan requires comparing hydraulic head measurements and water quality results to the model simulation. This comparison will be done twice, first at the end of year 2005, and again at the end of year 2006. The Trust's development of a flow and transport model and the current two year validation is a valuable step toward evaluating the nature of the plume.

VI. Five Year Review Process

Ohio EPA is conducting this five-year review for U.S. EPA. U.S. EPA has provided guidance to ensure all components of the remedy were reviewed. In addition U.S. EPA has provided input to ensure consistency with the Five Year Review Guidance format.

Community Involvement

A public notice was placed in the Hamilton Journal News on October 25, 2004. The notice announced that a five-year review was to be performed for the Site. Notice of the completed five-year review will be placed in the Hamilton Journal News and the final report will be available at the information repository. The information repository is located at the Site.

Document Review

The following documents were reviewed as part of this review:

1. Chem-Dyne Site Trust Fund 2004 Annual Report; S.S. Papadopulos and Associates; June 2005
2. Chem-Dyne Site Trust Fund 2003 Annual Report; S.S. Papadopulos and Associates; June 2004
3. Chem-Dyne Site Trust Fund 2002 Annual Report; S.S. Papadopulos and Associates; April 2003
4. Chem-Dyne Site Trust Fund 2001 Annual Report; S.S. Papadopulos and Associates; July 2002
5. Chem-Dyne Site Trust Fund 2000 Annual Report; Conestoga-Rovers and Associates; July 2001
6. Conceptual ground water flow model (memorandum); S.S. Papadopulos and Associates; 2002
7. Groundwater Flow Model, Chem-Dyne Site, Hamilton; S.S. Papadopulos and Associates; June 27, 2003
8. Groundwater Transport Model, Chem-Dyne Site, Hamilton (memorandum); S.S. Papadopulos and Associates; June 20, 2004
9. Results of an Investigation of the Impact of Increasing Withdrawals at the North Wellfield for the City of Hamilton; Smith-Comesky, LLC; September 2002
10. Work Plan for Changes to the Groundwater Extraction System at the Chem-Dyne Site, Hamilton, Ohio; S.S. Papadopulos and Associates; July 14, 2004
11. Work Plan for Changes to the Groundwater Extraction System at the Chem-Dyne Site, Hamilton, Ohio; S.S. Papadopulos and Associates; December 21, 2004
12. Task Descriptions and Revised Schedule for the Completion of Groundwater Flow and Transport Models and Associated Work Plan Activities; Revised: July 29, 2005

Data Review

The Remedial Action Plan discusses three primary environmental objectives. These are: 1) protection and enhancement of ground water quality; 2) protection of surface water; and 3) protection of public health. In order to meet these objectives the Chem- Dyne Trust maintains a remedy with three main components. These components are: 1) a site cap; 2) institutional controls; and 3) a ground water extraction and ex-situ water treatment system. Data pertaining to the ability of each of these remedial components to meet the objectives of the Consent Decree were reviewed. The remedial components are discussed in the following sections: site cap, institutional controls, and ground water extraction system.

Site Cap

The remedy calls for a multi-layer cap installed over the residual contaminated soil. The cap consists of 6 inches of topsoil overlying 6 inches of loam. This upper zone overlies 16 inches of sand. The sand overlies two feet of low permeability clay. A liner consisting of high density polyethylene is in place at a depth of 22 inches below ground surface. The remedial objectives of the cap are to provide protection from exposure to contamination and to reduce contaminant loading to ground water from soil. Section V, Paragraph 8.4 (c) of the Consent Decree describes the programs for monitoring performance. Originally neutron probes were used. In 1999 the agencies agreed to the Trust's request to discontinue the use of neutron probes. The programs remaining for evaluating the site cover are: 1) quarterly visual inspection of the cap for slumping and erosion; and 2)destructive testing of coupon samples of the synthetic liner every third year. In a telephone conversation between the Trust's plant manager and Ohio EPA the week of July 25, 2005, the plant manager related that visual inspections indicate that the cap is in good condition.

A report summarizing the most recent destructive coupon test results, for a coupon retrieved in April 2005, were sent to Ohio EPA for review. As explained in the report, dated May 24, 2005, eight high-density polyethylene liner coupons were installed in 1986 proximate to and under the same conditions as the Site cover upon construction of the cap. As required by the Consent Decree, every third year one coupon is removed and destructively tested to evaluate long term liner performance. An Ohio EPA engineer evaluation of the report concluded that the integrity of the cap is declining with time, but is meeting remedial objectives.

The cap appears effective in stopping direct exposure with waste. Although the cap may meet permeability requirements, the cap only partially limits contaminant loading to ground water. Seasonal trends in ground water VOC results indicate that contaminant loading from soil to ground water is occurring. In the spring the water table beneath the site rises several feet. The rising water table coming into contact with overlying soil contaminated with residual VOCs likely explains the observed seasonal fluctuations in ground water VOC concentrations.

Institutional Controls

Institutional controls in the form of ground water use restrictions are mandated in the Consent Decree. Section VII, Paragraph E of the Decree states that "the State agrees to use its statutory and regulatory authority to prohibit the installation of wells into contaminated groundwater at or near the Chem Dyne Site within the area marked on Appendix 5, or as it may be enlarged or reduced by Ohio EPA following consultation with U.S. EPA." This stipulation is consistent with Ohio Administrative Code (OAC) 3745-9-04, which regulates the location of new wells and does not allow installation of wells in areas where contamination may be drawn into the well.

In order to comply with of Ohio EPA's obligations under the Consent Decree, Ohio EPA sent letters in the spring of 2002 to the owners of the major industrial and municipal ground water pumping wells near Chem-Dyne. The letters informed them of the State of Ohio's obligation to use its authority to prohibit pumping which could adversely affect the ground water extraction system at Chem-Dyne. These letters were sent to the City of Hamilton, International Paper Co. (owner of the former Beckett Paper Co.), and Smart Paper Co. (formerly Champion Paper Co.).

In November of 2002, the City of Hamilton informed Ohio EPA of its intention to install two new production wells, north of the Chem-Dyne Site, approximately 1,500 feet south of the North Wellfield. The purpose of the wells was to provide coolant water to the Hamilton power plant. Upon learning of the proposal Ohio EPA facilitated communication between the city and the Trust for the purpose of identifying means of assuring the ground water extraction system at Chem-Dyne would not be adversely affected. The City of Hamilton proposed that their current wellhead protection model was not refined enough to address the potential affect on Chem-Dyne. Later, all parties agreed that a network of ground water monitoring wells, located along the Ford Hydraulic Canal would be helpful in evaluating hydraulic containment at Chem-Dyne, should the proposal move forward. In November, 2003 the Ohio EPA, Division of Drinking and Ground Waters met with the City of Hamilton to review their proposal for three monitoring wells along the Ford Hydraulic Canal. These wells were installed. As of June 28, 2005, the proposed production wells have not been installed.

Ground Water Extraction System

The Consent Decree requires operation of a ground water extraction system designed to reduce the ground water plume to stated levels and hydraulically contain the plume. Subparagraph 2.05 defines the plume by the 100 ug/L total priority pollutant volatile organic compound isopleth of 1986. The system is designed to maintain an inward hydraulic gradient, both vertically and horizontally, and to ensure that contaminants within the plume boundary are contained for removal and treatment. The ground water extraction system is operating in compliance with the terms of the Consent Decree and hydraulic containment is being maintained.

As required by the Consent Decree, performance of the system shall be evaluated annually. The ability of the system to maintain containment shall be based on hydraulic head measurements and water quality results (Consent Decree, Section 2.4.5). Hydraulic containment of the plume within the 100 ug/L isopleth of 1986 was demonstrated each year covered by the span of this five year review: August 2000 through August 2005.

Section 2.11 establishes that designated wells south and southwest of the Site will be in compliance if the higher of : a) any water quality criteria for protection of human health (based on 10^{-6} health risk criteria) or ; b) background conditions; or c) detection limits, have not been exceeded during and for five years after the termination of system operations. The 2004 annual report indicates that two chlorinated ethene compounds were detected above detection limits in year 2004 (Table 2). These compounds are trichloroethene (TCE), and cis-1,2-dichloroethene (cis-1,2-DCE). The MCL of 5 ug/L for trichloroethene was exceeded in September 2004 at compliance well MW-16.

Table 2. Southern Compliance Well VOC Detections (ug/L)

	April 2004		September 2004	
	TCE	cis-1,2-DCE	TCE	cis-1,2-DCE
MW-17	1.69	1.93	3.17	not detected
G-21	1.85	not detected	not detected	not detected
MW-16	4.84	not detected	6.07	not detected

The RI completed in 1984 determined that ground water south and southwest of the Site had not been affected by the Site, at that time. Subsequent data from compliance monitoring began showing VOCs in the southern wells in 1989. In 1990, the agencies required the Trust to investigate. The Trust concluded that the source of VOCs was a plume of unknown origin. The Trust also made the following recommendations: 1) continue monitoring the southern compliance wells with the understanding that samples from these wells are not indicative of ground water migrating from the Site; 2) apply compliance criteria specified in the Consent Decree for the southern compliance wells after the termination of the extraction system; and 3) reassess conditions in the vicinity of the southern compliance wells after at least a year of water level and water quality data collection. The last five year review states that "the agencies concurred with the Trust's recommendations to continue monitoring and to re-evaluate the situation periodically."

Compliance criteria are being met for western compliance wells . Section 2.12 establishes compliance criteria for designated wells west of the Site as follows: a) total priority pollutant VOCs may not exceed 100 ug/L during system operations and 5 years after termination; b) other priority pollutants may not exceed the maximum concentration found, at wells MW30, GW1, MW31, MW18, G3, MW33, G9, G10, G11, G12, and G3, prior to system

commencement and; c) other priority pollutants may not exceed the maximum concentration at such wells for five years after system termination. The last annual review also indicates that no MCLs were exceeded in the western compliance wells.

Compliance criteria were originally established for four production wells. Today only the Hamilton power plant well is still in operation. No VOCs were reported detected in the 2004 annual report.

Implementation of the changes to the ground water extraction system prescribed in the Work Plan for Changes to the Groundwater Extraction System at the Chem-Dyne Site, Hamilton, Ohio (revised Dec. 21, 2004) began on October 5, 2004. The change consisted of shutting down 13 of 23 extraction wells. Therefore the extraction system is currently operating with 1 intermediate and 9 shallow extraction wells. Since approval of the work plan, hydraulic containment is being reviewed on a quarterly basis. Water level maps for the shallow and intermediate zones of the aquifer have been submitted for January, April, and July 2005. The results indicate that containment is being achieved for both zones of the aquifer. The implementation of the changes to the ground water extraction have been successful in demonstrating capture with fewer operating wells. Results of this ground water sampling will provide an increased understanding of the nature of the VOC ground water plume.

Site Inspection

On June 1, 2005, Matt Justice of Ohio EPA, DERR split ground water samples with the Chem-Dyne Site. The June sampling event was the third quarterly water sampling event to take place since the shutdown of extraction wells as part of the modifications to the ground water pump and treat system (See Section 7.3.4). Ohio EPA split samples with the Trust at the following monitoring wells: MW-9, MW-11, MW-15, MW-31, and MW-34. In addition Ohio EPA collected a split sample from extraction well SE-7. Both the Trust and Ohio EPA samples were analyzed by an independent laboratory for VOCs using U.S. EPA method SW-846 8260 (b). Ohio EPA compared its results to the Trust's results. See Table 3 for a comparison of the sampling results for the following chlorinated ethenes: tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride (VC). The comparison shows that where these chemicals were detected, the Ohio EPA results were higher. Yet Ohio EPA observed that the Trust results for chlorinated ethanes were generally higher. These observations have been shared with the Trust. In order to explain the difference in results, Ohio EPA and the Trust will share and review lab quality assurance reports pertaining to the sampling event.

Table 3. Chlorinated ethene split sample comparison (ug/L), June 1, 2005

Well Name	PCE		TCE		VC	
	Trust	OEPA	Trust	OEPA	Trust	OEPA
MW9	ND	9.34	1.58	2.23	ND	ND
MW11	ND	ND	ND	ND	ND	ND
MW15	12.7	28.4	9.69	14.4	67.2	94.2
MW31	2.93	13.3	12	17.9	ND	1.45
MW34	ND	ND	ND	ND	ND	1.09
SE7	33.8	64.8	58	90.2	53	69.5

Another purpose for visiting the Site was to observe and evaluate the ground water sampling technique used by the Trust. The sampling procedure Ohio EPA observed in the field was found to be in accord with the Quality Assurance Plan Plume Definition Sampling Chen-Dyne Site Remediation Program of 1985. The same personnel have conducted the sampling for 18 years; therefore, there is remarkable consistency in sample collection over time. As observed, Trust personnel purge a maximum of three well volumes prior to sampling. Because field parameters are recorded after sampling rather than during purging, no data are available to determine in the field whether water column stabilization prior to sampling has occurred. Once purge water has been removed, the sampling plan requires that a teflon bailer be lowered to retrieve sample. In the case of 4 inch diameter wells, the wells are purged with a submersible pump, then sampled with a bailer.

Since the plan was adopted in 1985, advances have been made in ground water VOC sampling. Adopting some of these advances at the Site could improve sample efficiency and representativeness. Ohio EPA suggests that the Trust evaluate several options to bailing. The act of lowering and raising a bailer creates turbulence and aerates the water column, and in so doing promotes degassing of VOCs. Two options to bailing are as follows: a) retrieve sample with the submersible pump used for purging; or b) switch to a dedicated network of pumps using the micro-purge low flow sampling technique (Technical Guidance Manual for Hydrogeological Investigations and Ground Water Monitoring, Ohio EPA, 1995).

The micro-purge low flow sampling method used with a network of dedicated pumps would generate the most representative discrete VOC samples. This method of sampling is ideal for large sites requiring frequent sampling. Using this method, water is extracted from a submersible pump at a rate less than the ground water flow velocity; therefore no drawdown is produced. Significant time savings may also be realized, because no purge water is generated, and if dedicated equipment is used, sampling equipment will not need to be inserted and decontaminated. The most important advantage is that a discrete VOC sample with high reliability is obtained.

Interviews

During the inspection Ohio EPA noted that some monitoring wells yield less than three well volumes during purging. Mr. Ron Holt, the Site operations manager, was interviewed in the field on whether wells dewater during purging. As a follow up to the interview, Ohio EPA requested the Trust submit a list of wells in the monitoring network which go dry during purging. The following table provided by the Trust summarizes such wells as reported to Ohio EPA in June 2005.

Table 4. Wells which dewater during purging, June 2005.

Well	Recovery Rate	Location	Relative Depth
G2	1 foot every 15 minutes	inside plume	shallow
MW12	6 to 8 hours	inside plume	intermediate
MW20	approximately 1 hour	western compliance	shallow
MW30	several months	inside plume	shallow
MW32	several days	western compliance	deep
MW34	several days	inside plume	shallow

The slow recovery of these wells appears to be indicative of well screen fouling or incomplete initial well development. The fact that less than three well volumes can be purged increases the likelihood that stagnant water will be sampled. In such cases, the sample results will most likely be biased low. Given the prolific nature of the aquifer and the depth of the wells indicated, sufficient hydraulic head should be present for complete and near instantaneous recharge of water to the well. An inspection of the wells is recommended to determine the best means for restoring hydraulic communication between the aquifer and the well screen.

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision?

The remedy is operating in compliance with the Consent Decree. The ground water extraction system is providing hydraulic containment. However results from the Site also suggest that the criteria for terminating the pump and treat system will be difficult to achieve in a timely and cost-effective manner, unless the system is augmented. There are remedial technologies today that did not exist at the time the remedy was selected, which are proving effective for in-situ VOC remediation of soil ground water. Augmenting the ground water extraction system with one or more in-situ technologies could greatly enhance removal rates and result in a more timely, cost efficient attainment of termination criteria.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?

The attainment of 100 ug/L total priority pollutant VOCs is a remedial objective of the ground water extraction system for compliance points west of the Site. It is also one of the criteria specified by the Consent Decree for terminating operation of the ground water extraction system. Specifically, the Consent Decree requires the reduction of total priority pollutant VOC concentrations within the original (1986) plume boundary to a level below 100 ug/L. The Consent Decree, lodged in 1985, was one of the first settlements of a major ground water clean-up under CERCLA, predating the 1986 SARA amendments to CERCLA, the 1990 NCP, and the federal sole-source aquifer designation of 1988. MCLs for many of the VOCs at the Chem-Dyne Site, standards which CERCLA/SARA would require today, had not yet been promulgated. The Chem-Dyne remedy is protective today due to the ongoing operation of the hydraulic containment system and reliance on institutional controls to prevent exposure to contaminated ground-water, and to control ground-water uses which would negatively impact the integrity of the hydraulic containment system. Given that some contamination will remain at the Chem-Dyne Site at the conclusion of the remedial action at levels that would present an unacceptable risk if exposure were to occur, it is recommended that EPA conduct a review of the adequacy of existing institutional controls with respect to their ability to ensure long-term protection of public health and the environment.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new information has come to light which could call into question the protectiveness of the remedy.

VIII. Issues

No issues were identified concerning remedy protectiveness. However issues were identified concerning mass removal efficiency and the ability of the ground water extraction system to reach termination criteria within a reasonable time frame.

Ground Water Extraction System Termination

A reduction in VOCs to specified levels is necessary before the ground water extraction system can be for terminated. The termination criteria in Section 2.8 of the Consent Decree still apply to this system, now in its 18th year of operation. Section 2.8 of the Consent Decree states that once concentrations of total priority pollutant VOCs become effectively constant for each monitoring and extraction well within and on the defined plume boundary, as defined in Section 2.16 of the Decree, but the performance goal of 100 ug/L has not been met in each well, operations may be terminated if: a) substantial compliance with the performance goal of 100 ug/L total priority pollutant VOCs has been achieved; and b) it is determined that no reasonable system modification or adjustment, as agreed by the plaintiffs and the settling defendants, will produce significant improvement within the remainder of the twenty year period following commencement of system operations.

Both the Agencies and the Trust recognize that termination criteria have not been met. The 2004 annual report explains that 5 wells had total VOC concentrations above 100 ug/L. The most recent water quality results from June 2005 indicate 7 wells had total VOCs above 100 ug/L.

The Consent Decree, Section 2.9 explains that at the commencement of the 20th year of system operations, both plaintiffs and settling defendants shall determine whether system operations may be terminated. At the same time, the termination criteria of Section 2.10 must also be met. Section 2.10 specifies that concentrations of total priority pollutant VOCs within the Site and the plume boundary must be maintained effectively at or below the levels reached at the termination of the extraction system for a period of five years after termination. Current observations suggest that meeting this criteria will be difficult to achieve with ground water extraction alone. For example, since the Agency-approved shutdown of some extraction wells in October 2004, as part of the flow model validation, VOC concentrations have been increasing in some monitoring wells.

Since implementation of the changes to the extraction system in October 2004, total VOC trends have changed in several wells. A decreasing trend may be present in some wells. A rising trend in total VOCs is present in other wells. The most significant rising trend in total VOCs appears at shallow extraction well SE-7. Prior to the modification to the extraction system, total VOCs in well SE-7 were below 100 ug/L. After modification in October 2004 total VOCs had risen to 1,580 ug/L (March 2005). Another significant rising trend is focused at intermediate extraction well IE-1, northwest of SE-7, near the power plant. Prior to the modification to the extraction system, total VOCs in IE-1 were 327 ug/L (December 2004). After modification to the extraction system total VOCs had risen to 1,039 ug/L total VOCs (March 2005).

Ohio EPA suggests that the source responsible for persistent VOCs at IE-1 and SE-7 is upgradient, in the former drum area adjacent to the Ransohoff Building. The June 1-9, 2005 water quality data, obtained since the system modifications, reinforce the hypothesis that the former drum area near the building feeds a northwesterly migrating plume. Concentration maps produced by the Trust acknowledge a shallow zone plume between the Ransohoff Building and the power plant (Figure 2). However the same area between the Ransohoff Building and the power plant is interpreted as absent of an intermediate plume (Figure 3). Ohio EPA suggests that there is a strong possibility that an underlying intermediate plume exists. Therefore, Ohio EPA recommends the Trust's interpretation be confirmed through sampling in the hatched area depicted in Figure 4. As illustrated, the hatched area for which the shallow plume is interpreted, is absent of intermediate depth monitoring wells.

The persistent nature of the ground water plume indicates the presence of residual source material beneath the cap. This hypothesis is supported by the cyclical nature of VOC influent air stripper concentrations. Figure 5 plots air stripper influent concentrations for tetrachloroethene, trichloroethene, and vinyl chloride between January 2002 and May 2005. As shown, the maximum concentrations occur in the spring. The springtime maximum concentrations correlate with seasonally high levels of the water table. A probable explanation for the correlation is that as the water table rises in the spring, it encounters residual waste, which is subsequently dissolved and released to ground water.

As shown on Figure 5, tetrachloroethene constitutes more dissolved mass than its potential breakdown products. The fact that tetrachloroethene and trichloroethene dominate over their potential breakdown products suggests that degradation of source mass through reductive dehalogenation is not occurring efficiently. Unless ground water extraction is augmented, the termination terms of the Consent Decree will not be met in an efficient time frame.

Mass Removal Efficiency

The cumulative VOC mass removed from the aquifer since the beginning of operations in February 1987 to the end of 2004 is approximately 33,600 lbs. Initially the mass removal rate was efficient. In the first four years of operation 21,823 lbs of VOCs were removed. In other words 65% of the total VOCs removed occurred during the first four years of operation. However in the last four years, between the end of year 2000 to the end of 2004, approximately 1,599 lbs or only 4% of the total cumulative mass was removed. The cumulative mass removal curve in Figure 6 illustrates that mass removal rates are essentially steady. However, the annual mass being removed is still significant. Approximately 270 pounds were removed in year 2004.

Ground water extraction has been successful in the past in achieving hydraulic containment and in removing significant dissolved phase mass . However, it appears now in the mature phases of ground water extraction, most of the remaining mass is bound to

soil or aquifer matrix rather than being distributed in the dissolved phase. Therefore future ground water extraction will prove effective primarily for hydraulic containment.

In order to generate the asymptotic mass removal rates shown in Figure 6, the release of contaminant residuals must be slow relative to pumpage induced ground water flow. One phenomena which could contribute to the persistent nature of the plume is the slow desorption of VOCs from low hydraulic conductivity sediments. Today there are technologies, that did not exist at the time the RAP was finalized that are proving effective in addressing diffusion from low hydraulic conductivity sediments. Augmenting the ground water extractions system with one or more in-situ technologies could greatly enhance removal rates and result in a more timely, cost efficient attainment of termination criteria. Ohio EPA recommends that the Trust identify in-situ remedial technologies to aggressively treat VOC source areas.

Ground Water Sampling

The ground water sampling technique observed during the site inspection was found to be in compliance with the sampling and analysis plan of 1985. However since 1985, advances have been made in ground water VOC sampling. Adopting some of these advances at the Site could improve sample efficiency and representativeness.

IX. Recommendations and Follow-up Actions

Issue	Recommendation
1. Between August 6th and August 14th of 2002, the air stripper had to be shutdown for extensive maintenance. As a result, the ground water extraction system had to also be shutdown. The long term effects of calcification and iron precipitation solidified the packing material in the stripper tower, thereby blocking air flow. In response, the tower packing material was replaced in the summer of 2002	In order to avoid future shutdowns of the ground water extraction system and maintain efficient influent treatment, reporting effluent concentration trends with time is recommended in future annual reports. Such reporting will help indicate the need for preventative maintenance.

Issue	Recommendation
2. Since the Site sampling plan was adopted in 1985, advances have been made in ground water VOC sampling. The Trust could improve its sampling methods at the Site to increase sampling efficiency and sample representativeness.	Ohio EPA recommends identifying alternatives to sampling with a bailer. The act of lowering and raising a bailer creates turbulence and aerates the water column. In so doing degassing of VOCs is promoted. Two options to bailing are as follows: a) retrieve sample with the submersible pump used for purging; or b) switch to a dedicated network of pumps and use the micro-purge low flow sampling technique. Ohio EPA guidance on ground water mirco-purge low flow sampling is contained in chapter 10, page 30 of the document Technical Guidance Manual for Hydrogeological Investigations and Ground Water Monitoring, Ohio EPA, 1995). Chapter 10 may be accessed from the web at the following link: http://www.epa.state.oh.us/ddagw/Documents/tgmguid10sapmay2005.pdf The micro-purge low flow sampling method used with a network of dedicated pumps, would generate the most representative discrete VOC samples. It is ideal for large sites requiring frequent sampling. Using this method, water is extracted from a submersible pump at a rate less than the ground water flow velocity, which produces no drawdown. Purge water is not generated and significant time savings result from no longer having to insert and decontaminate sampling equipment. The most important advantage to this method is that a discrete VOC sample with high reliability is obtained. Ohio EPA recommends having a discussion with U.S. EPA and the Trust to evaluate options for improving ground water sampling.

Issue	Recommendation
3. Another improvement that can be made to increase sample representativeness is to use field parameter values to determine water column stabilization, and thus determine when representative sample may be collected.	Ohio EPA recommends discussing the matter with the Trust to identify feasible improvements that may be made.
4. After the Ohio EPA's Site inspection and interview, Ohio EPA noted that six monitoring wells yield less than three well volumes or dewater during purging. The slow recovery of these wells appears to be indicative of well screen fouling or poor initial well development. The fact that less than three well volumes are being purged means that fresh water is not replenishing the well during sampling. In wells where this is occurring, sample results will most likely be biased low. Given the prolific nature of the aquifer and the depth of the wells, sufficient hydraulic head should be present for near instantaneous well recharge.	An inspection of the wells by the Trust, and submittal of a plan proposing means for restoring hydraulic communication and assuring representative sample collection is recommended.
5. Ground water extraction has been successful in the past in achieving containment and in removing significant dissolved phase volatile organic compound mass. However the plume persists. Results indicate that the persistent nature of the ground water plume is attributable to residual source material. This residual material is more difficult to remove. It is also not degrading through reductive dehalogenation efficiently. Given the nature of the residual source material, future ground water extraction will likely prove effective primarily for hydraulic containment.	In order to meet the termination criteria of the Consent Decree in an efficient time frame, Ohio EPA recommends that the Trust explore means of identifying source areas, and then aggressively treating those source areas with in-situ remedial technologies.

Issue	Recommendation
6. The ground water extraction system has reached a point where it is primarily effective for hydraulic containment.	In addition to identifying and treating source areas with in-situ remedial technologies, Ohio EPA recommends the Trust consider adapting the ground water extraction system to a plume perimeter network for the chief purpose of maintaining hydraulic containment. Decreasing pumpage in the plume interior will reduce the affect of dilution on neighboring monitoring wells. By so doing, interior plume monitoring wells will be apt to provide more representative discrete results and enable improved plume interpretation.
7. Ohio EPA suggests VOCs present at extraction well IE-1 may be coming from an intermediate zone plume migrating from the vicinity of the Ransohoff Building. The Trust interprets a shallow plume extending continuously from the Ransohoff Building toward the power plant. However the Trust does not interpret an equivalent underlying intermediate plume. No intermediate depth monitoring wells exist along the potential flow path from the Ransohoff Building to the power plant.	Ohio EPA recommends the Trust submit a ground water sampling plan to determine the extent of VOCs in the intermediate zone. Ohio EPA Figure 4 illustrates an area for which an intermediate plume may be present, but for which no monitoring wells exist. Ohio EPA recommends that the Trust sample the approximate hatched area illustrated in Figure 4 to define whether an intermediate plume exists. Ohio EPA also recommends that the Trust undertake concurrent shallow soil sampling for the area to determine if an off-site VOC source is present.
8. Residual VOC sources appear to exist in soil. This source material will not be remedied in an efficient time frame through ground water extraction.	8. The Trust's development of a flow and transport model with the current two year model validation is a valuable step toward evaluating the nature of the plume. Ohio EPA recommends that the Trust use the validation results to assist in the identification of source areas responsible for the shallow and intermediate plume.

Issue	Recommendation
9. Three southern compliance monitoring wells were found to contain chlorinated ethenes above detection limits in year 2004 (see Table 2). In 1990 the Trust stated that VOC detections in the southern compliance wells were not attributable to the Site. This position is supported by hydraulic potential maps which consistently indicate westerly flow across the Site. However southerly or southwesterly flow could be established upon termination of the ground water extraction system. Ground water pumping no longer occurs at Champion Paper, on the west side of the Great Miami River. This change could increase the potential for southerly or southwesterly flow. Southerly or southwesterly flow could reach the southern compliance wells. Ohio EPA wishes to ensure an adequate duration of post ground water extraction system termination monitoring at the southern compliance wells. The Consent Decree requires five years of post-termination water quality monitoring. However Ohio EPA calculated a travel time of 5.5 years from MW-10 at the Ransohoff Building (former drum area) to southern compliance well MW-16. This was based on an average linear velocity of 0.5 ft/day (see RI, May 22, 1985).	It is Ohio EPA's understanding that in 1990 the Trust recommended that the Consent Decree criteria for the southern compliance wells be applied upon termination of the ground water extraction system. Ohio EPA recommends confirming if that is the Trust's position. A travel time of greater than five years from the former drum area to the southern compliance wells is possible. For this reason Ohio EPA recommends discussing options with the Trust, that may be taken to ensure an adequate duration of post ground water extraction system termination monitoring.
10. Residual source mass at the Site, if left in place after the remedial action, could provide unacceptable future risk.	Enforceable Institutional Controls such as deed restrictions, covenants, and easements will be evaluated by a U.S. EPA institutional control study in the next six months to assist in providing long term environmental stewardship.

X. Protectiveness Statement

The site remedy is protective of human health and the environment. It is functioning in compliance with the terms of the Consent Decree. The ground water extraction system continues to provide hydraulic containment .

XI. Next Review

The next five-year review for the Chem Dyne site will be due September 2010, five years from the submittal of this review.

Figures

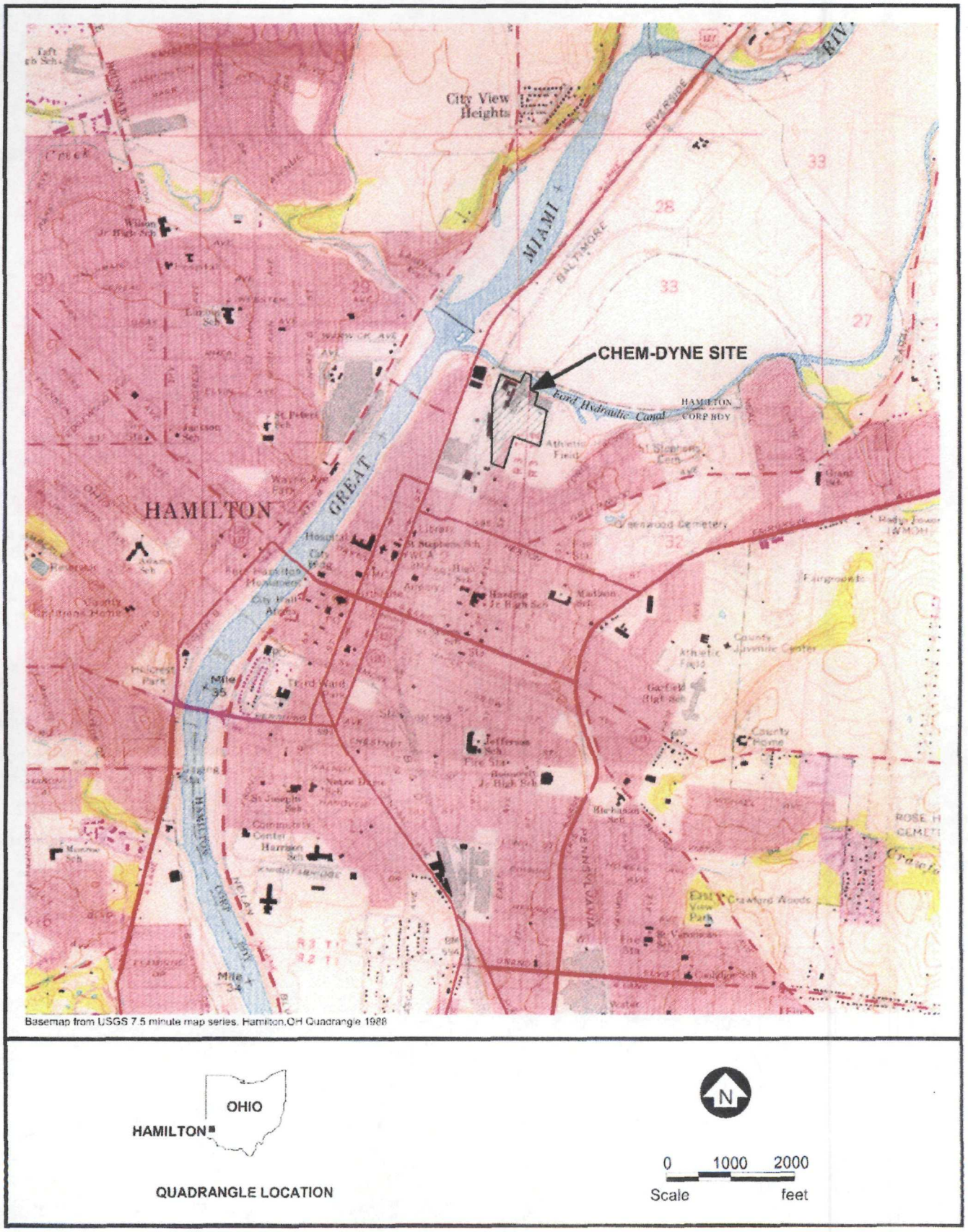
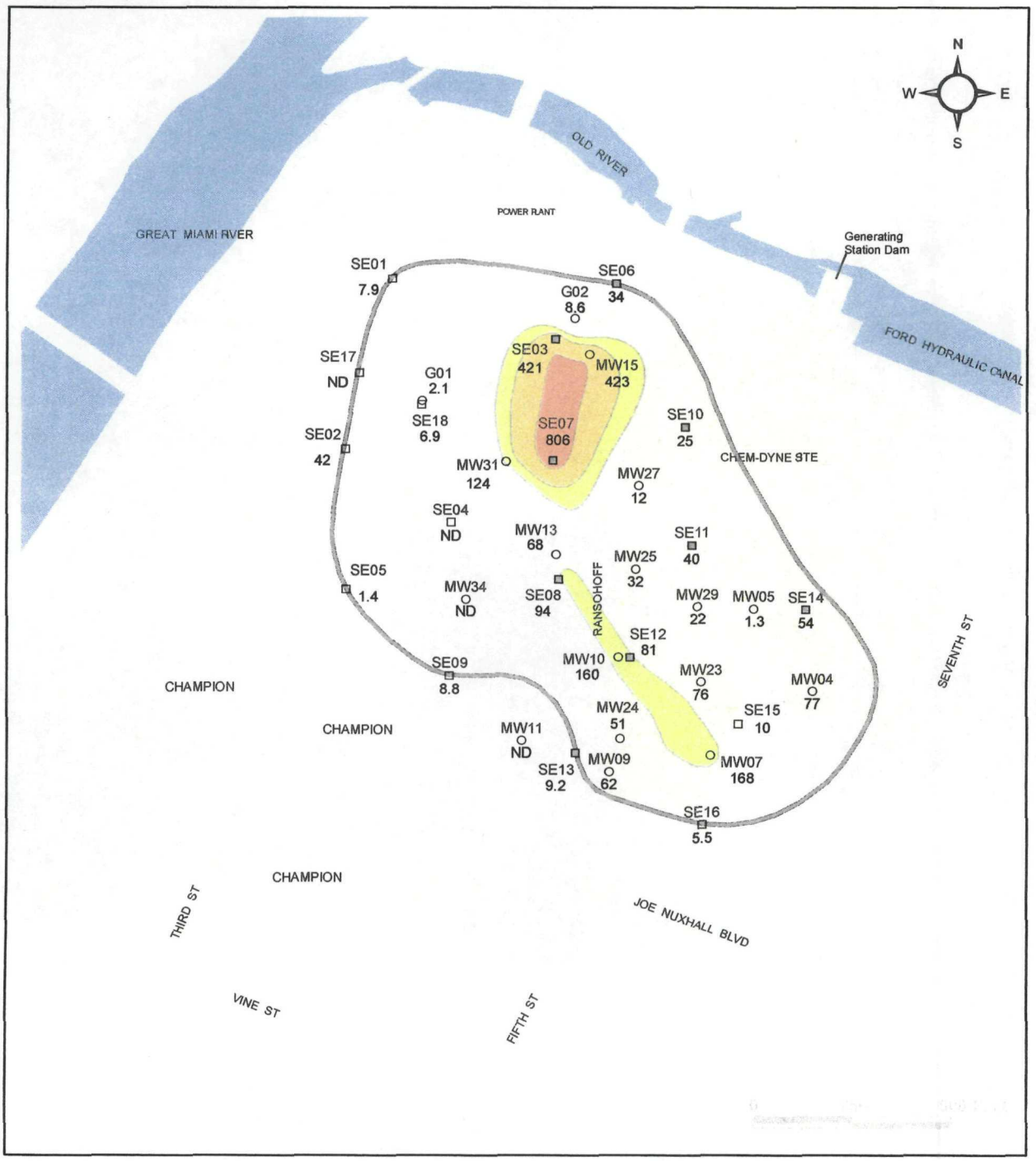


Figure 1 Location of Chem-Dyne Site

Figure 2
Chem-Dyne Five-Year Review



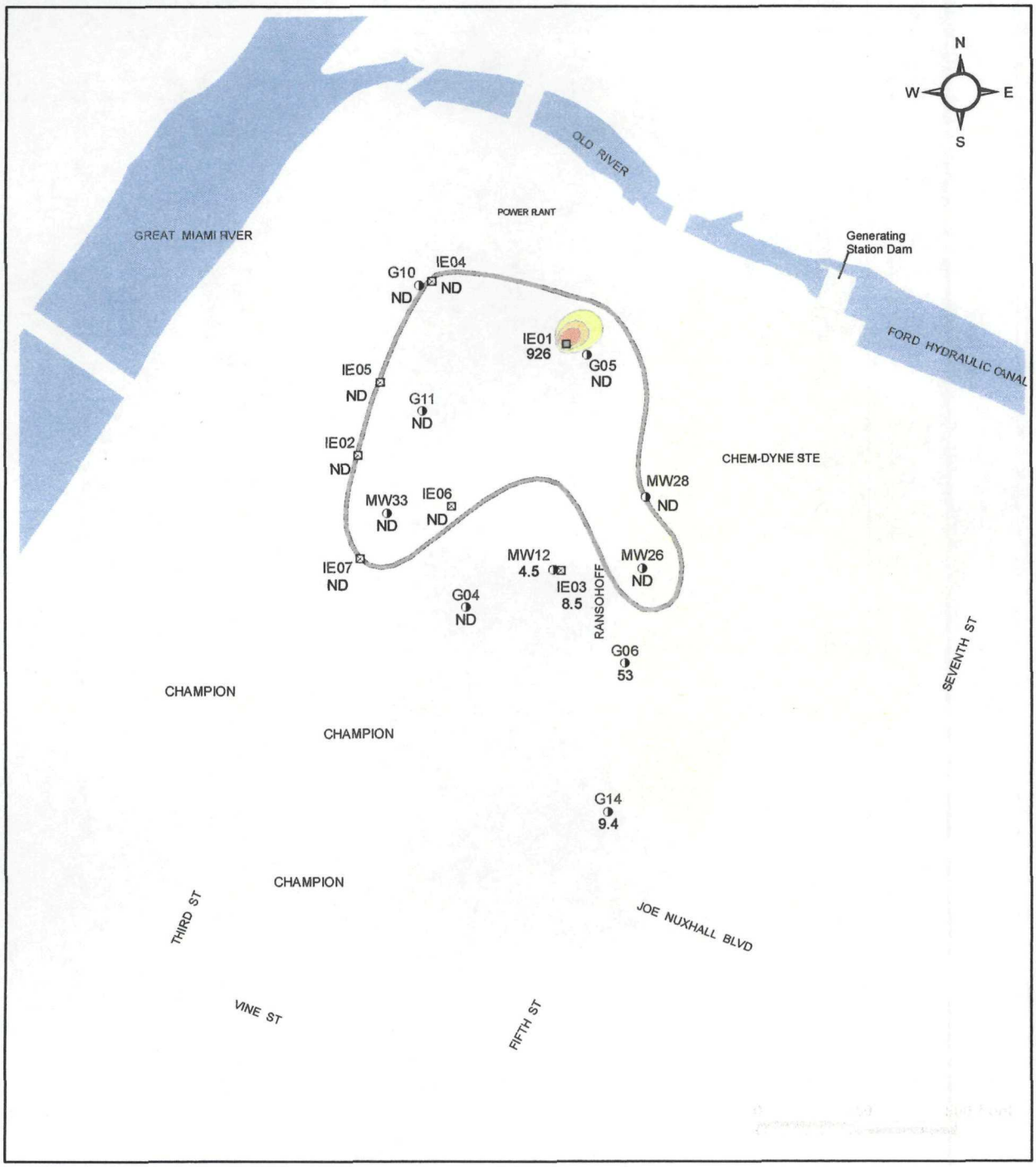
Explanation

- ○ Shallow Monitoring Well
- Shallow Extraction Well
  - ■ Pumping
  - □ Not Pumping
- Shallow Plume Boundary (1986)
- 1.3 ○ Total VOCs in ug/L
- ND None Detected

Concentration, ug/L
- 100 - 200
- 200 - 500
- 500 - 1000

Total VOC Concentrations in Shallow Wells Sampled June 1-9, 2005

Figure 3
Chem-Dyne Five-Year Review



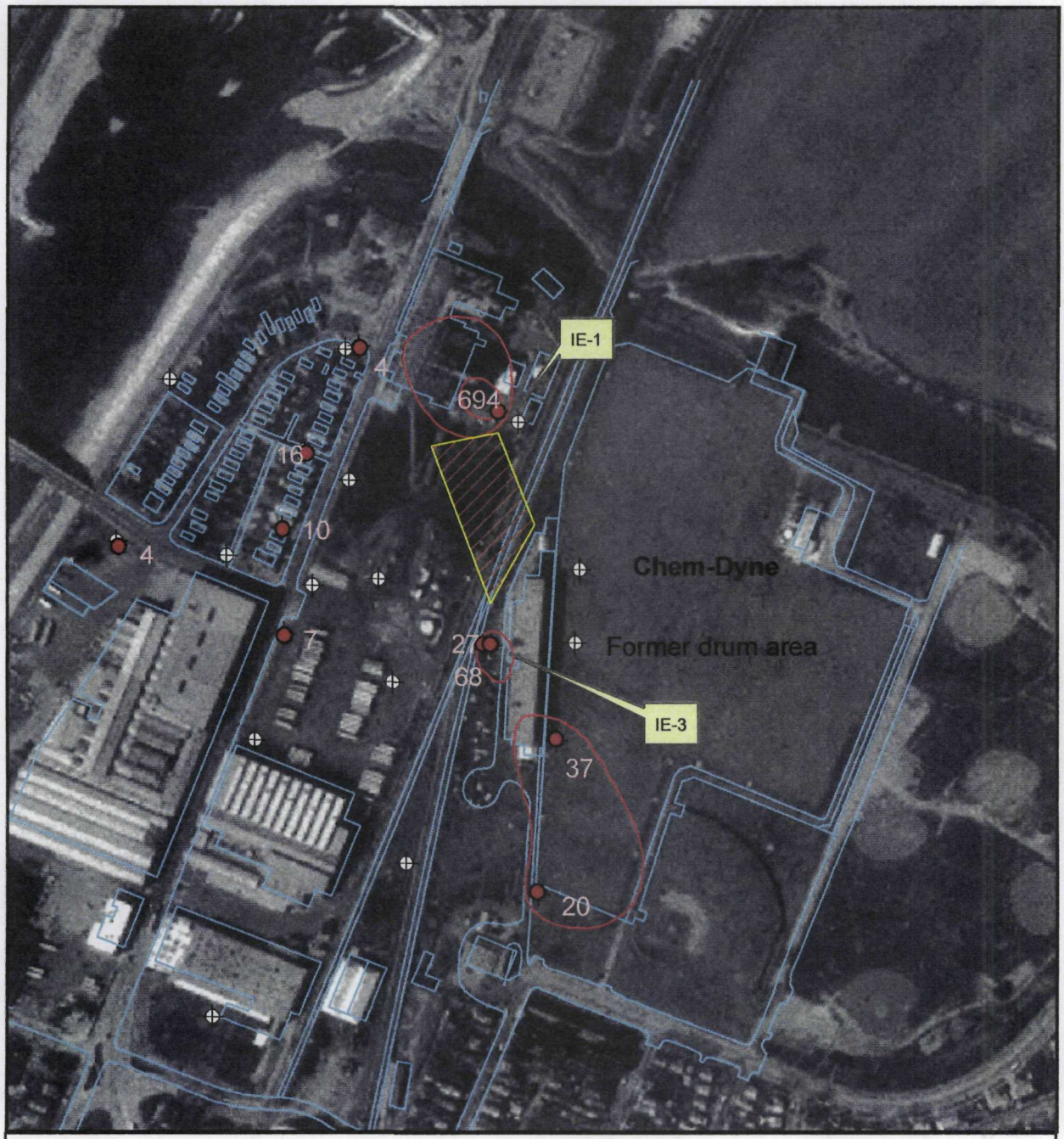
Explanation

- Intermediate Monitoring Well
- Intermediate Extraction Well
  - Pumping
  - Not Pumping
- Intermediate Plume Boundary (1986)
- 4.5 Total VOCs in ug/L
- ND None Detected

Concentration, ug/L
- 100 - 200
- 200 - 500
- 500 - 1000

Total VOC Concentrations in Intermediate Wells Sampled June 1-9, 2005

Figure 4. Chem-Dyne Intermediate Plume
2003 Average Total VOCs (ug/L)



0 200 400 Feet

Scale: 1:4,800

1 inch 400 feet

N

10 ug/L isopleth: SSP&A

Potential plume core without monitoring

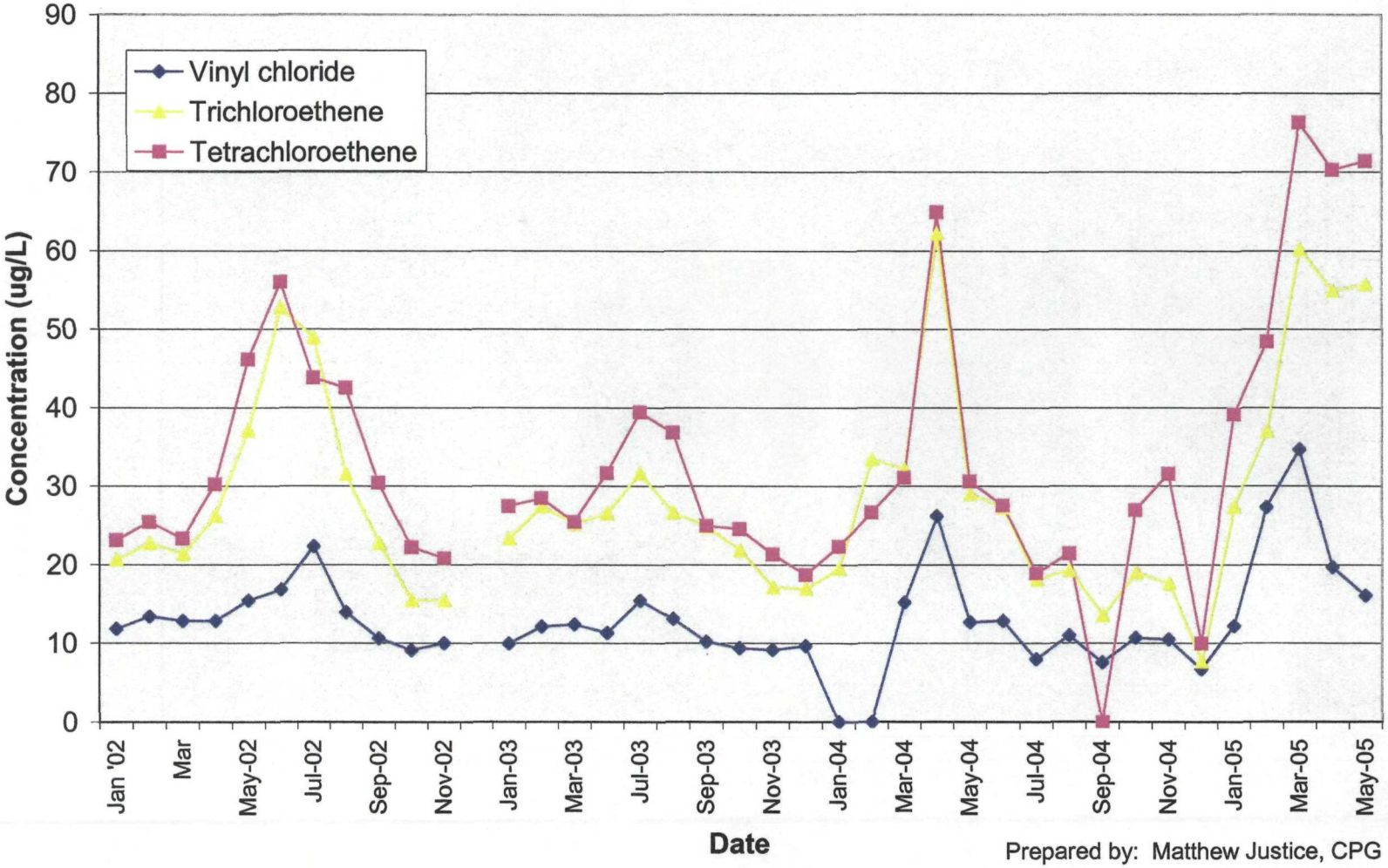
Intermediate well with no VOC detection

Intermediate well with VOC detection(s)

Prepared by: Matthew Justice, CPG
Date: August 15, 2005

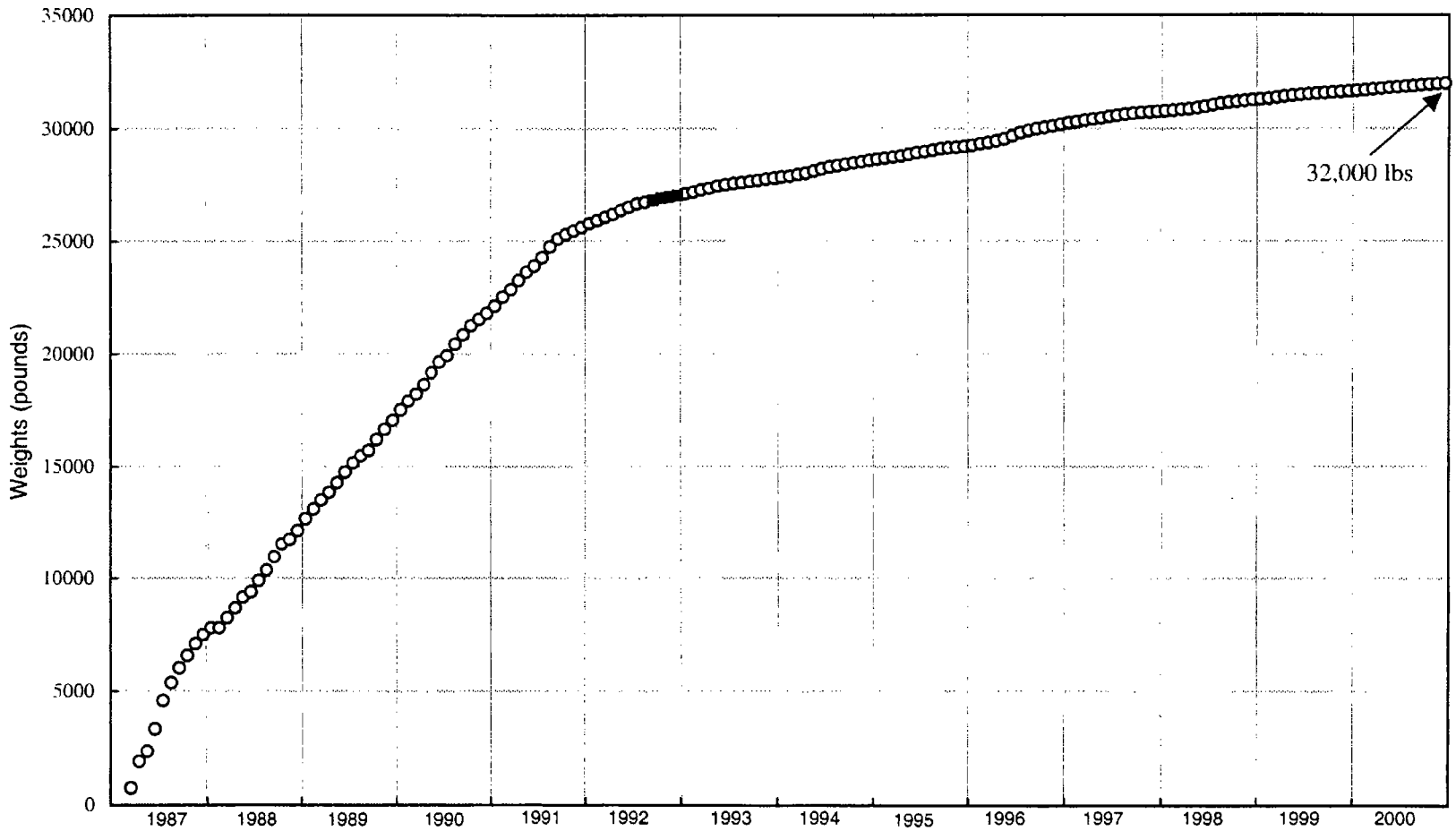
OhioEPA

Figure 5.
Influent Concentration with Time



Prepared by: Matthew Justice, CPG

Figure 6
Chem-Dyne Five-Year Review



NOTE : September, October, November and December 1992 cumulative weights are based on estimated concentration.

Figure 5.19 Cumulative Mass of Priority Pollutant VOCs Removed from Plume

State of Ohio Environmental Protection Agency

Southwest District

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Bob Taft, Governor
Bruce Johnson, Lt. Governor
Joseph P. Koncelik, Director

CERTIFIED MAIL

September 8, 2005

Ms. Lolita Hill
U.S. Environmental Protection Agency
Region 5 (HS RM 6-J)
77 West Jackson Boulevard
Chicago, Illinois 60604

Re: Second Five-Year Review, Chem-Dyne Site, Hamilton, Ohio

Dear Ms Hill:

Ohio EPA is pleased to submit the enclosed five-year review report, final version, for the Chem-Dyne Site. If I may be of further assistance, please do not hesitate to contact me at (937)285-6031 or by e-mail at matt.justice@epa.state.oh.us.

Sincerely,

Matt Justice

Matt Justice, CPG
Site Coordinator, DERR/Ohio EPA

Enclosure

cc: Heidi Sorin, DERR/CO

MJ/br

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Bob Taft, Governor
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CERTIFIED MAIL

August 15, 2005

Ms. Lolita Hill
U.S. Environmental Protection Agency, Region 5 (HS RM 6-J)
77 West Jackson Blvd.
Chicago, IL 60604

RE: Second Five-Year Review, Chem-Dyne Site, Hamilton, OH

Dear Ms Hill:

Ohio EPA is pleased to submit the enclosed five-year review report, draft final version, for the Chem-Dyne Site. If I may be of further assistance, please do not hesitate to contact me.

Sincerely,

Matt Justice

Matt Justice, CPG
Site Coordinator, DERR/Ohio EPA
(937) 285-6031

Enclosure

cc: Heidi Sorin, DERR/CO